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A Floristic Survey of Selected Sites in the Loup River Valley, Nance County, Nebraska

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ABSTRACT The Loup River Valley of Nebraska contains natural, undisturbed wet meadows with significant plant diversity. Even though these sites are infrequent and are often intermixed with heavily grazed pastures or cultivated fields, they support numerous plant and animal species that do not occur elsewhere. We surveyed three study sites (an ungrazed wet meadow; a grazed wet meadow; and a riparian area) that totaled approximately 68.8 ha during the 2010 and 2011 growing seasons. We compiled an annotated vascular plants checklist for the study area that included 244 plant species of which about 49% (119) were new county records. The mean coefficient of conservatism (Cm) values for the ungrazed meadow, the grazed meadow, and the riparian site were 3.54, 3.07, and 3.35 respectively. The floristic quality indices (FQI) were 37.96 for the hay meadow, 28.14 for the grazed meadow, and 31.07 for the riparian site. Jaccard's Index of Similarity (31.4%) indicated that the grazed and ungrazed meadows had a high degree of community similarity with each containing ~ 80% native species. Our study substantiates the significance of Nance County to the species richness and flora of Nebraska and the Great Plains. Future research and reconnaissance should include the identification and study of additional natural meadows in the lower Loup River Valley.

KEY WORDS floristic analysis, Loup River Valley, wet meadows

Nance County, Nebraska, is located in east-central Nebraska and is traversed from west to east by the Loup River, a tributary of the Platte River (Fig. 1). Its boundaries are very irregular because in 1857 it was originally set aside as a reservation for the Pawnee Tribe. In 1875 the U.S. Government moved the Pawnee to other territory and it was subsequently opened for settlement. The native vegetation was mostly tallgrass prairie except along streams where woody vegetation was dominant. Much of the original vegetation has been converted to cultivated cropland or grazed pastures. The major crops are corn, small grains (wheat and oats), and soybeans (USDA 1960).

The Loup River Valley

The lower Loup River Valley in Nance County, Nebraska, is formed from three tributaries, the South Loup, the Middle Loup and the North Loup, that converge west of the study area in Howard County. With their source in the Sand Hills, the tributaries of the Loup River system receive water from the many Sand Hills' lakes and aquifers (Rothenberger et al. 2010). The Loup River itself is spring-fed which allows for generally consistent flows since the system is not directly dependent on precipitation (Nagel and Rothenberger 1998, Steinauer 1998). Meadows and marshes bordering the river are sub-irrigated and provide some of the most diverse plant communities in the Loup Valley with over 600 documented vascular plant species (Rothenberger 2000). Although many wetland species are confined to these meadows and marshes, many upland species can be found in the fringes of the wetlands. Thus, these relatively small areas have a large impact on a region's biodiversity (Gutzmer and Kaul 2008). The number and size of these areas, however, is shrinking (Naiman et al. 1993, Rothenberger et al. 2010). Ninety-nine percent of the original tallgrass, mixed-grass, and wetland prairies have been used for urban and/or agricultural purposes (Gutzmer and Kaul 2008). The lack of prairie fires and the post settlement introduction of invasive species threaten to further degrade these small microcosms (Bowles and Jones 2006).

Most remaining marshes and meadows of the Loup Valley have been impacted by various disturbances so that original plant communities have been altered (Gutzmer and Kaul 2008). For example, uniform flows of the Loup River have encouraged diversion of its waters for irrigation and power generation (Steinauer 1998). By 1935, as many as 35 hydroelectric plants diverted water from the Loup to generate electricity (Steinauer 1998). Today, east of Genoa, the Loup River is diverted to supply water to two hydroelectric plants, one at Monroe and one at Columbus, generating over 150 million kilowatt-hours of electricity annually (Loup Power District 2013). Flows below these diversion canals are reduced to a small fraction of those in the past, resulting in significantly shorter hydroperiods for affected wetlands (Steinauer 1998). Upstream, however, flows are relatively consistent and comparable to past flows throughout the season (Nagel and Rothenberger 1998). Several major irrigation diversion projects, such as the Sherman County Reservoir and others on the Calamus River and Davis Creek, have changed the landscape over the last century (Steinauer 1998). These changes have eliminated many essential habitat features resulting in a loss of diversity (Naiman et al. 1993). The proximity of many of these areas to cultivated cropland also impacts native plant communities. Run-off containing fertilizer, pesticides and herbicides also negatively af-

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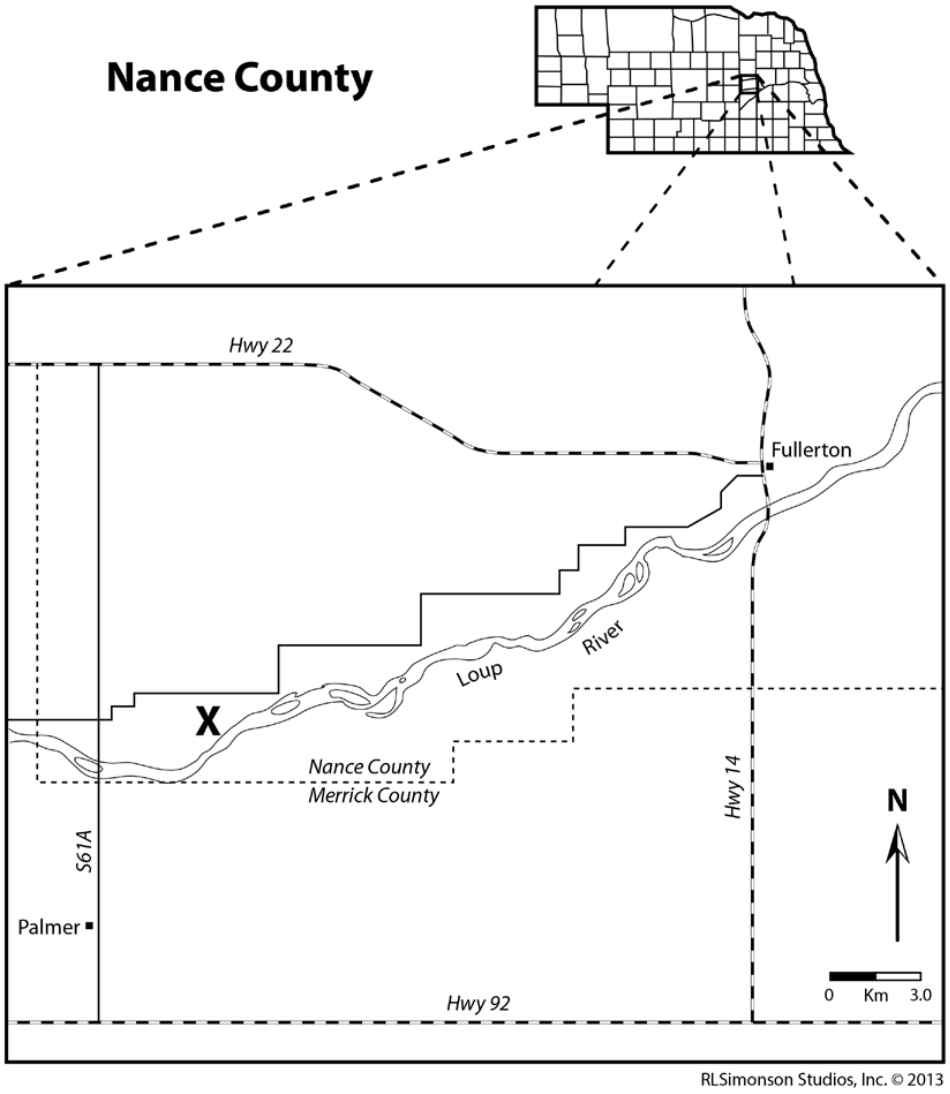

Figure 1. Approximate location (X) of the three study sites (NE ¼ of E ½ of Section 14, T15N, R8W) in southwestern Nance County, Nebraska, 2010–2011.

fects native flora, allowing invasive species on disturbed sites to become better established (Smith and Haukos 2002). While proximity to cropland has impacted natural plant communities, the fragmentation of the formerly continuous riparian corridor also has had detrimental effects. Franklin (1993) stressed the importance of a healthy hyporheic zone, the saturated area below and adjacent to streams and riverbeds, a feature common in the sub-irrigated wet meadows of the Loup Valley.

More than 75% of wetland areas associated with the Loup River receive some annual grazing and/or haying (Rothenberger et al. 2010). This can affect the flora in a number of ways. Martin and Chambers (2002) found that grazing resulted in a net loss of nitrogen, leading to a change in species composition and a decrease in biomass production. Native grass species richness decreased while invasive species richness increased in the grazed areas under study. The timing of grazing, haying, and burning also affects species composition as early grazing or haying favors warm-season species and delayed grazing or haying allows cool-season species to set seed (Dornbush 2004, Towne et al. 2005, Bowles and Jones 2006). Additionally, cattle grazing may lower the pH of the soil (Walters and Martin 2003). This may reduce alkaline habitat to the extent that species at least facultative in their need for a higher pH, such as the threatened western prairie-fringed orchid (*Platanthera praeclara*), would be affected (Fritz 1993, Bowles et al. 2005). Despite a variety of anthropogenic impacts, the Loup River Valley contains some of the highest floristic diversity in Nebraska.

Previous Studies

In 1996, the Nebraska Game and Parks Commission and the University of Nebraska at Kearney, funded by the Bureau of Reclamation, initiated a project to identify native flora, fauna and plant communities in the Middle Loup Valley below Dunning and the Loup River Valley below the Sargent-Farwell irrigation diversion project (Steinauer 1998). This project resulted in the identification of more than 500 vascular plant species from 26 sites along the Middle Loup and Loup Rivers in Central Nebraska (Nagel and Rothenberger 1998). Gutzmer and Kaul (2008) collected plants for 12 years, 1996–2007, in the Loup River and Platte River basins of Platte County, compiling a county list based not only on their collections but also those housed in other herbaria in the state. Rothenberger et al. (2010) did extensive collecting and research on two wet meadows in Sherman County between 2005 and 2007. These studies supplemented the original study by the Nebraska Game and Parks Commission. The above-described studies concluded that this region hosts flora common to the Sand Hills from the north, tallgrass prairie to the east, mixed-grass prairie in central Nebraska, relic oak-ash forest near Dannebrog, and elm-ash-basswood forests in portions of the upper Loup Valley not typical of the area (Barker and Whitman 1988, Rothenberger 2008). Our study was initiated because the plant species of the Loup River Valley in Nance County have not been adequately documented and the biological importance of Loup River wet meadows is exceptional. Thus, our objectives were to 1) further substantiate the diversity of plant species at the Nance County study sites, 2) document new county records, and 3) provide plant species data for comparison to other studies in the Loup River Basin.

STUDY AREA

Our study site (68.8 ha) was located on the north side of the Loup River (Fig. 1) approximately 8 km east of the western county line (NE 3/4 of E 1/2 of Section 14, T15N, R8W) and consisted of three continuous sites. The northern 44.5 ha was a wet ungrazed hay meadow which was mowed early in the season (mid-June) on an annual basis. The middle 16.2 ha was wet meadow that was moderately grazed during part of every growing season (except 2010). The third tract was an 8.1-ha portion of riparian forest and riverfront (including a small semi-permanent sandbar) that had reportedly never been grazed or hayed. During our study, the grazed pasture was unexpectedly altered by a joint project of the Nebraska Game and Parks Commission and Ducks Unlimited. The slough or channel that originally drained the pasture was deepened to form two ponds. This construction allowed several exotic species to colonize areas of disturbance which consequently affected the plant species composition of the grazed meadow.

METHODS

We extensively sampled the three contrasting sites (grazed pasture, ungrazed wet meadow, riparian area) during the 2010 and 2011 growing seasons. We made early, mid and late-season collections by systematically walking through the three sites, identifying and collecting all species that were not previously documented in our study. Where possible, we collected specimens approximately 14 days apart along north-south and east-west transects. We collected, pressed, and dried voucher specimens for all new county records and deposited them in the University of Nebraska at Kearney Herbarium (NEBK). Plant nomenclature followed *The Flora of Nebraska, Second Edition* (Kaul et al. 2011). We compiled all documented species to create a vascular plants checklist (Appendix 1). We primarily used Kaul et al. (2011) to assist in plant identification and occasionally consulted field guides and manuals by Johnson and Larson (1999), Stubbendieck et al. (1995), and Farrar (2011). We assigned a coefficient of conservatism (C-value) to each native species (Swink and Wilhelm 1994), with C-values for Nebraska determined by Rolfsmeier and Steinauer (2003). These values rank native species at a given site on a scale of 0 to 10. Higher numbers give greater importance to native species that are limited to a narrow range of environmental conditions and are sensitive to disturbance. Low C-values are assigned to plants that are adapted to a variety of habitats, including disturbed ones, and often produce thousands of seeds per plant. Although subjectively determined, Mushet et al. (2002) concluded that C-values determined by experts in the field provide adequate information to perform accurate quality assessments. We calculated mean C-values (Cm) and floristic quality indices for the grazed pasture, the wet meadow, and the riparian sites. We determined the floristic quality index using the formula $FQI = Cm\sqrt{n}$, where n equals the total number of native plant species in the study. The floristic quality of an area is directly related to its richness in native species (Swink and Wilhelm 1994), although researchers disagree as to the accuracy of site assessment if only the native plants are included in calculation of FQI (Mushet et al. 2002, Bowles and Jones 2006, Ervin et al. 2006,). An index that takes into account all species has a stronger correlation to non-native species, and omitting the non-native species might result in an overestimation of ecological integrity (Ervin et al. 2006). We compared our results to those from two other Loup River Valley wet meadow studies recently completed in Sherman County (Thomsen Meadow) and Buffalo County (Pleasanton Meadow).

For comparison to other studies, we took soil samples in triplicate to a depth of 20 cm from two locations in the hay meadow using a step tube-type sampler. A step tube sampler or step probe (Forestry Suppliers Inc., Jackson, MS, USA) is a soil probe that extracts the upper 25 cm of topsoil in a core. It has a t-shaped handle and a metal bar attached on the side that enables the worker to push the soil tube into the

ground by pressing downward with the foot. We deemed one location to be representative of a major portion of the large hay meadow, while we obtained a second sample from a section of higher ground with sandier soil. We air-dried the soil samples in the lab for 28 days and sent them to Ward Laboratories in Kearney, Nebraska, for analysis to determine percent organic matter, pH, and macronutrient (NPK) content. We consulted the Nance County soil survey (Kollmonger et al. 1955) to determine the soil types of the three study sites.

We determined community similarity of the hay meadow and the grazed pasture using Jaccard's Index of Similarity (IS_J; Mueller-Dombois and Ellenberg 1974, Stohlgren et al. 1997, Qian 2001) where J = A /(A + B + C) * 100; A = number of species in both sites, B = number of species in site 1, but not site 2, C = number of species in site 2, but not site 1. The IS_J value is an indication of the proportion of shared diversity between two sites (Swink and Wilhelm 1994, Real and Vargas 1996,). We considered communities to be part of the same association if the IS_J value is only in the range of 25–50% (Mueller-Dombois and Ellenberg 1974)

RESULTS

We collected 144 species in the hay meadow, and 115 were native (79.9%), while in the grazed pasture, 78.5% of the species were native (84/107; Table 1). Mean C-values (Cm) of the hay meadow, grazed pasture, and riparian area ranged from 3.07 to 3.54 (Table 1). Jaccard's Index of Similarity (31.4%) indicated that hay and grazed meadows shared common community characteristics. We documented 244 plant species on the three sites combined; 119 species were new county records (Appendix 1), and 198 species (81.1%), were native. We observed several weedy exotics, including hemp (*Cannabis sativa*) and downy brome (*Bromus tectorum*), that colonized areas of the grazed meadow disturbed by the construction project. Fraser's onion (*Allium candensis* var. *fraseri*) was present in the grazed pasture only as isolated specimens (Appendix 1). Although we collected no plants classified as rare, threatened, or endangered, several new county records had high C-values, including Fraser's wild onion, blue-jointgrass (*Calamagrostis canadensis*), and hairy spring panicum (*Panicum ovale* var. *praecocius*; Appendix 1). The grazed pasture contained a small number (6–8) of trees and shrubs, such as coralberry (*Symphoricarpos orbiculatus*), green ash, (*Fraxinus pennsylvanica),* honey-locust, (*Gleditsia triacanthos*), and rough-leaf dogwood, (*Cornus drummondii)* not present in the hay meadow.

DISCUSSION

Nance County, Nebraska is an ideal region for botanical exploration. Fortunately, a number of native, lowland wet meadows have been preserved and are of primary importance to the botanical diversity of the area. These meadows are undisturbed except for occasional grazing or mowing as a source of prairie hay.

The Lower Loup River Valley has historically been underrepresented floristically as our limited study discovered 119 new county records reinforcing the diverse status of the area. The floristic quality indices of the three sites were relatively low (≤38%), but the species checklist included a high percentage (81%) of native species. In Michigan, natural areas with FQI values >35 qualify as floristically important with high levels of conservatism and richness (Herman et al. 2001); plant communities with FQI values ≥50 are rare. Though our study sites were low in floristic quality, the number of native species (81.1%) was greater than sites previously studied in the Republican and Platte River Valleys where native species may comprise less than 60% of the total (Rothenberger et al. 2010).

The hay meadow site, a remnant of lowland tallgrass prairie (Kaul et al. 2011), was composed of Loup and Sarpy fine sandy loams, and approximately 90% of the Sarpy soil was imperfectly drained. The north third of the grazed meadow was composed of the same wet Sarpy sandy loam as the meadow but was replaced by Sarpy loamy fine sand toward the river front (Kollmonger et al. 1955). In the hay meadow site, lowland soil pH, organic matter, and nitrate nitrogen averaged 8.43, 2.33, and 4.00 ppm, respectively. On the sandier site, soil pH, organic matter, and nitrate nitrogen averaged

Table 1. Total species collected, native species, percent native species (%N), mean C-value (Cm), Floristic Quality Index (FQI), and percent graminoids (%G) for the hay meadow (HM), grazed pasture (GP), and the riparian site (RF), Nance County, Nebraska, 2010–2011.

Site	Total Species	Native species	%N	Cm	FQI	%G
HM	144	115	79.86	3.54	37.96	37.14
GP	107	84	78.50	3.07	28.14	28.30
RF	108	86	79.62	3.35	31.07	32.41

6.97, 2.20, and 3.60 ppm, respectively. Soil pH values (8.43 lowland and 6.97 sandy site) were comparable to the Sherman County meadows sample by Veloso and Rothenberger (2008), where pH values for a similar lowland and sand meadow were 8.35 and 6.50 respectively.

Species composition of the hay meadow was influenced by annual mowing and the proximity of the pasture to the wooded river site. A solitary red cedar seedling was the only tree identified in the hay meadow. The hay meadow contained visible stands of two varieties of *Allium* distributed throughout. The timing of the annual mowing favored an even distribution of ripe bulblets and seeds. The two meadow sites characteristically lacked invasive species such as smooth brome (*B. inermis*), purple loosestrife (*Lythrum salicaria*), leafy spurge (*Euphorbia esula*) and introduced thistles (*Carduus* and *Cirsium* spp.) that are common problems in the north-central plains. The grazed meadow contained some invasive species, but 78% of the total plants recorded were native. In general, grazing reduces native plant diversity, although careful management reduces these effects (Clary and Kinney 2002, Walters and Martin 2003). Previously studied meadows in Buffalo, Platte, and Sherman counties also resulted in important botanical discoveries. For example, the threatened white lady's slipper orchid (*Cypripedium candidum*) was reported in Loup River meadows in both Sherman and Platte Counties (Gutzmer and Kaul 2008, Rothenberger et al. 2010). In this study, no rare or threatened species were found, although our study sites have the potential to support additional discoveries.

We also sampled the small section of riverfront and riparian forest, including a semi-permanent sandbar. This small tract was composed of Plains cottonwood (*Populus deltoides* subsp. *monilifera*) riparian woodland, with two overlapping shrub communities: sandbar willow (*Salix exigua* subsp. *interior*) and dogwood (*Cornus drummondii* and *C. sericea*) /false indigo (*Amorpha fruticosa*) shrubland (Kaul et al. 2011). Collecting on this site increased the species richness of the overall study.

During fall 2010, our study was unexpectedly impacted when Ducks Unlimited and the Nebraska Game and Parks Commission deepened the slough area that traversed the grazed pasture from west to east. Before the project, the slough was a marshy area supporting a variety of emergent hydrophytes with little open surface area. After the project, all surface water was confined to the pond area, essentially draining the marsh. This likely affected the species diversity of our study by allowing weedy exotics such as hemp (*Cannabis sativa*), buffalo bur (*Solanum rostratum*) and ragweed (*Ambrosia spp*.) to become established on the disturbed ground.

MANAGEMENT IMPLICATIONS

Of the three sites we surveyed, the ungrazed wet meadow contained the highest FQI (37.96), Cm (3.54), and total number of plant species (144). Ungrazed meadows in the Loup River Valley are often managed by conscientious landowners who mow these areas annually for hay. The ungrazed meadow we studied was normally mowed early in the season (late Jun), but some landowners prefer to mow later (mid-Aug). Our findings suggested that species diversity was not markedly reduced by these practices, though we recommend that wet meadows of the lower Loup River Valley be identified, mapped, and protected to preserve future biodiversity of the area.

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Appendix 1. An annotated list of each species collected in Nance County, Nebraska, 2010–2011. The annotated list contains the scientific name (alphabetized), common name, Coefficient of Conservatism (C) and site of occurrence: hay meadow (HM), grazed pasture (GP), or riparian (RF). An asterisk (*) in the C-value column indicates a non-native species. An asterisk (*) after the scientific name indicates a new Nance County record. Nomenclature follows Kaul et al. (2011).

Scientific Name	Common Name	C	HM	GP	RF
*Achillea millefolium**	common yarrow	2	X	X	
*Agrimonia gryposepala**	tall agrimony	5		X	
*Agrostis hyemalis**	ticklegrass	4	X		
*Agrostis stolonifera**	redtop	*	X	X	
Allium canadense var.*canadense**	wild garlic	3	X	X	
Allium candense var. *fraseri*	Fraser's wild onion	7	X	X	
Alisma triviale	water plaintain	4	X	X	
*Alopecurus arundinaceus**	creeping foxtail	*			X
Ambrosia artemisiifolia	common ragwood	0	X	X	X
*Ambrosia psilostachya**	western ragweed	1		X	
Ambrosia trifida	giant ragweed	0	X	X	
Amorpha fruticosa	wild indigo	5	X	X	X
*Andropogan gerardii**	big bluestem	5	X		
Antennaria neglecta	field pussytoes	3	X		
Apocynum cannabinum	Indian hemp dogbane	2	X	X	
*Arctium minus**	common burdock	*	X		
*Artemisia ludoviciana**	white sage	4		X	X
Asclepias incarnata	swamp milkweed	4	X	X	X
*Asclepias speciosa**	showy milkweed	1	X		
*Asclepias stenophylla**	narrow-leaf milkweed	6	X		
Asclepias syriaca	common milkweed	1	X	X	X
*Astragalus canadensis**	Canada milkvetch	5	X	X	X
Aster ericoides	heath aster	3	X	X	
Aster praealtus	willowleaf aster	5	X		
Bidens cernua	bur marigold	3	X		
Boehmeria cylindrica	false nettle	6	X		
*Bolboschoenus fluviatilis**	river bullrush	3	X	X	
Bouteloua curtipendula	side-oats grama	5	X		
*Bouteloua gracilis**	blue grama	4	X		
Bromus inermis	smooth brome	*		X	X
*Bromus japonicus**	Japanese brome	*	X	X	
*Bromus tectorum**	downy brome	*		X	
Buchloë dactyloides	buffalo grass	2	X		
*Calamagrostis canadensis**	bluejoint grass	6	X		
*Callirhoë alcaeoides**	pink poppy-mallow	5	X	X	
*Callirhoë involucrata**	purple poppy-mallow	2	X	X	
Calystegia sepium var. *angulata**	hedge bindweed	1	X		
Cannabis sativa	hemp	*	X	X	

Scientific Name	Common Name	C	HM	GP	RF
Carex blanda	common wood sedge	2			X
Carex brevior	fescue sedge	4	X	X	
Carex crawei	Crawe's sedge	6	X		
Carex cristatella	crested sedge	5		X	X
*Carex eleocharis**	needle-leaf sedge	2	X		
Carex emoryi	Emory's sedge	5		X	X
Carex granularis var. *haleana*	Hale's meadow sedge	6	X		
Carex gravida	heavy sedge	4		X	X
Carex grisea	gray wood sedge	3			X
*Carex heliophila**	sun sedge	5		X	
*Carex hystericina**	bottlebrush sedge	5			X
*Carex molesta**	troublesome sedge	3			X
Carex pellita	wooly sedge	4	X	X	
Carex praegracilis	clustered field sedge	4		X	
*Carex scoparia**	pointed broom sedge	5		X	
*Carex stipata**	sawbeak sedge	5			X
Carex tetanica	rigid sedge	7	X		
Carex vulpinoidea	fox sedge	4	X	X	
Catalpa speciosa	northern Catalpa	*			X
*Celtis occidentalis**	hackberry	4			X
*Chenopodium album**	lamb's quarters	*		X	X
*Chenopodium simplex**	maple-leaf goosefoot	1			X
Cirsium flodmanii	Flodman's thistle	4	X		
Cirsium vulgare	bull thistle	*	X		
*Conium maculatum**	poison hemlock	*			X
*Conyza canadensis**	horseweed	0	X	X	
Cornus drummondii	rough-leaf dogwood	3		X	X
Crepis runcinata	dandelion hawk's-beard	5		X	
Croton texensis	Texas croton	1	X	X	
Cuscuta glomerata	dodder	6			X
Cyclachaena xanthifolia	big marsh-elder	0	X		
Cyperus lupulinus	Great Plains flat-sedge	1	X		
Cyperus odoratus	rusty flatsedge	3			X
Cyperus schweinitzii	Schweinitz flatsedge	4	X		
Cyperus strigosus	umbrella sedge	4			X
*Dactylis glomerata**	orchard grass	*	X		
*Delphinium virescens**	prairie larkspur	6	X		
Descurainia pinnata	tansy mustard	0			X
Descurainia sophia	flixweed	*		X	X
Digitaria cognata	fall witchgrass	4			X
Eleocharis erythropoda	red-stem spikerush	5	X		
*Eleocharis palustris**	common spikerush	4	X		

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Eleusine indica	goosegrass	*			X
Elymus canadensis	Canadian wildrye	5			X
Elymus hispidus	intermediate wheatgrass	*	X		
*Elymus repens**	quackgrass	*	X		
*Elymus smithii**	western wheatgrass	3	X		
Elymus virginicus	Virginia wildrye	4			X
Equisetum arvense	field horsetail	4			X
Equisetum laevigatum	smooth scouring-rush	4	X	X	X
Eragrostis pectinacea	Carolina lovegrass	0		X	
*Eragrostis spectabilis**	purple lovegrass	3	X		
Erigeron philadelphicus	Philadelphia fleabane	3	X	X	X
Erigeron strigosus	prairie fleabane	2	X	X	
Euphorbia marginata	snow-on-the-mountain	0	X	X	
*Eustoma russellianum**	prairie gentian	4		X	
Fraxinus pennsylvanica	green ash	2		X	X
Galium aparine	catchweed bedstraw	0		X	X
Galium triflorum	sweet-scented bedstraw	4			X
Geum canadense	white avens	3		X	X
*Gleditsia triacanthos**	honey-locust	1		X	
Glyceria striata	fowl manna-grass	5	X		
*Grindelia squarrosa**	curly cup gumweed	1		X	
Hackelia virginiana	common stickseed	2			X
Hedeoma hispida	rough false pennyroyal	2	X		
Heliopsis helianthoides var. *scabra**	false sunflower	4			X
*Hordeum jubatum**	foxtail barley	1	X	X	
*Hordeum pusillum**	little barley	1	X	X	
Hypoxis hirsuta	yellow stargrass	7	X	X	
*Impatiens capensis**	spotted touch-me-not	4			X
*Iris pseudacorus**	yellow water iris	*			X
*Juncus balticus**	Baltic rush	6	X		X
*Juncus brachyphyllus**	short-leaf rush	6	X		
*Juncus bufonius**	toad rush	4			X
Juncus dudleyi	Dudley rush	5	X		
*Juncus effusus**	soft rush	6	X		
*Juncus interior**	inland rush	4		X	
Juncus nodosus	knotted rush	6			X
*Juncus tenuis**	path rush	3			X
Juncus torreyi	Torrey's rush	4	X		
Juniperus virginiana	eastern red-cedar	1	X	X	X
*Leonurus cardiaca**	motherwort	*			X
Lepidium densiflorum	peppergrass	0	X	X	
Lindernia dubia	false pimpernel	5			X

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Lippia lanceolata	northern fogfruit	3	X	X	X
*Lolium arundinaceum**	tall fescue	*	X	X	
*Lobelia spicata**	pale-spike lobelia	6	X		
Lycopus americanus	American water-horehound	4			X
*Lycopus asper**	western water-horehound	5			X
Lysimachia ciliata	fringed loosestrife	5		X	
Lythrum alatum	winged loosestrife	6			X
*Medicago lupulina**	black medick	*	X	X	
Melilotus alba	white sweet clover	*	X		
Melilotus officinalis	yellow sweet-clover	*	X		
*Mentha arvensis**	field mint	4			X
Mimosa quadrivalvis var. *nuttallii*	sensitive briar	6	X	X	
Mimulus ringens	Alleghany monkey-flower	6			X
*Mirabilis nyctaginea**	wild four-o'clock	1	X		X
Monarda fistulosa	wild bergamot	4		X	
Morus alba	white mulberry	*		X	X
Muhlenbergia mexicana	wirestem muhly	4			X
*Nepeta cataria**	catnip	*		X	X
Oenothera biennis	eastern evening primrose	1		X	
Onosmodium molle var. *occidentale**	false gromwell	4		X	
*Opuntia fragilis**	little prickly-pear	3		X	
*Opuntia humifusa**	eastern prickly-pear	5	X	X	
Oxalis stricta	wood sorrel	0	X	X	
Oxalis violacea	violet wood-sorrel	5	X		
Panicum capillare	witchgrass	0	X		X
Panicum oligosanthes var. *scribnerianum**	Scribner panicum	4	X	X	
Panicum ovale var. *praecocious**	hairy spring panicum	6	X	X	X
*Panicum virgatum**	switchgrass	4	X		
*Parietaria pensylvanica**	Pennsylvania pellitory	0			X
Parthenocissus vitacea	woodbine	4			X
Paspalum setaceum var. *stramineum*	slender paspalum	2	X	X	
*Pediomelum argophyllum**	silver-leaf scurf-pea	6	X		
*Pediomelum digitatum**	palm-leaf scurfpea	6	X		
*Penstemon grandiflorus**	large beardtongue	5	X		
*Phalaris arundinacea**	reed canary grass	0	X	X	X
*Phleum pratense**	timothy grass	*	X	X	X
*Phragmites australis**	common reed	3			X
Phryma leptostachya	lopseed	5			X
*Physalis heterophylla**	clammy ground-cherry	4	X	X	
Physalis longifolia	common ground-cherry	0	X		
Physalis virginiana	Virginia ground-cherry	6	X		X
*Pilea pumila**	clearweed	4			X

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Plantago rugelii	American plantain	0	X		X
*Poa compressa**	Canada bluegrass	*	X		
*Poa pratensis**	Kentucky bluegrass	*	X	X	
Polygonum aviculare subsp. *depressum**	knotweed	*	X	X	
*Polygonum convolvulus**	black bindweed	*	X		X
Polygonum lapathifolium	pale smartweed	2		X	
*Polygonum pensylvanicum**	Pennsylvania smartweed	0	X	X	
*Polygonum persicaria**	smartweed	*	X		
Populus deltoides subsp. *monilifera**	Plains cottonwood	3			X
*Prunella vulgaris**	self-heal	*	X		
*Prunus americana**	wild plum	3			X
*Prunus virginiana**	chokecherry	3			X
*Psoralidium tenuiflorum**	slender-flowered scurf-pea	5	X		
*Pycnanthemum virginianum**	Virginia mountain-mint	6		X	
Ranunculus sceleratus var. *sceleratus*	cursed crowfoot	*	X	X	X
Ratibida columnifera	prairie coneflower	4	X		
Rorippa palustris var. *glabra*	bog yellow cress	4	X		X
Rudbeckia laciniata	goldenglow	4	X		X
Rudbeckia hirta var. *pulcherrima**	black-eyed susan	4	X		
Rumex crispus	curly dock	*	X	X	
*Rumex altissimus**	pale dock	0	X		X
Sagittaria brevirostra	arrowhead	4	X	X	X
Salix amygdaloides	peach-leaf willow	4			X
Salix exigua subsp. *interior*	sandbar willow	3			X
*Sambucus canadensis**	elderberry	2	X		X
Sanicula canadensis	Canada sanicle	3			X
*Schizachyrium scoparium**	little bluestem	4	X		
Schoenoplectus pungens	three-square bullrush	4	X	X	X
Schoenoplectus tabernaemontani	softstem bullrush	5	X		X
Scirpus pallidus	pale bulrush	5		X	X
Scutellaria parvula	small skullcap	6	X		
Senecio plattensis	prairie ragwort	5	X		
Seteria pumila	yellow foxtail	*	X		X
*Seteria verticillata**	bristly foxtail	*		X	
*Seteria viridis**	green foxtail	*	X		X
Sphenopholis obtusata var. *obtusata**	wedgegrass	5			X
Silphium integrifolium	rosinweed	4	X		
Sisyrinchium campestre	prairie blue-eyed grass	5	X		
*Sisyrinchium montanum**	meadow blue-eyed grass	5	X		
Solanum ptychanthum	black nightshade	0	X		
Solanum rostratum	buffalo bur	0		X	
*Solidago canadensis**	Canada goldenrod	2	X		X

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Solidago gigantea	late goldenrod	3		X	
*Solidago missouriensis**	Missouri goldenrod	5		X	
*Sorghastrum nutans**	Indian grass	5	X		
Sparganium eurycarpum	bur-reed	5		X	
*Spartina pectinata**	prairie cordgrass	5	X	X	X
*Sporobolus compositus**	rough dropseed	3	X		
*Stellaria media**	common chickweed	*	X		
Stipa spartea	porcupine grass	6	X		
*Strophostyles leiosperma**	slick-seed wild-bean	4		X	X
Symphoricarpos orbiculatus	coralberry	2		X	
*Taraxacum officinale**	dandelion	*	X	X	X
Teucrium canadense var. *canadense**	American germander	4	X	X	X
Toxicodendron radicans var. *rydbergii**	poison ivy	2		X	X
Tradescantia bracteata	spiderwort	5	X	X	X
Tragopogon dubius	goat's beard	*	X		
*Tribulus terrestris**	puncture vine	*		X	
Tridens flavus	false redtop	2	X		
Trifolium pratense	red clover	*	X	X	
*Trifolium repens****	white clover	*	X	X	
Triodanis perfoliata	Venus's looking glass	2	X		
*Typha augustifolia**	narrow-leaf cattail	*	X	X	X
Typha latifolia	broad-leaf cattail	1	X		X
*Ulmus americana**	American elm	3			X
*Ulmus pumila**	Siberian elm	*			X
Urtica dioica subsp. *gracilis**	stinging nettle	1			X
Verbascum thapsus	mullein	*		X	
*Verbena bracteata**	prostrate vervain	0		X	
Verbena hastata	blue vervain	4		X	X
Verbena stricta	hoary vervain	2		X	
*Verbena urticifolia**	white vervain	3			X
Vernonia baldwinii	western ironweed	3	X	X	
*Vernonia fasciculata**	common ironweed	4		X	
*Veronica anagallis-aquatica**	Eurasian water speedwell	*			X
Vicia americana var. *minor*	American vetch	6	X		
*Viola sororia**	violet	1	X		X
*Vitus riparia**	river-bank grape	3	X		X
*Vulpia octoflora**	sixweeks-fescue	3	X	X	
Xanthium strumarium var. *canadense**	cocklebur	1			X